EAR AFFECTIONS AND MENTAL DISTURBANCES.*

EMIL AMBERG, M.D.,
DETROIT, MICHIGAN.

(*Continued from page* 576.)

Class II (cases 4-8), in which mental disturbance may have been caused by: A, exhaustion; B, local irritation; C, intoxication. That mental disturbances are caused by any of these three factors is known.

We know of the severe symptoms which may occur in children suffering from acute middle ear affections. Walb[15] mentions that in children, especially during the first years of life, during the course of an otitis media perforativa the cerebral symptoms can be so prominent that a meningitis is supposed to be present and not a middle ear inflammation.

Jacobson[16] says: "During such a rise of temperature (40° Celsius=104° Fahrenheit) an acute perforative middle ear inflammation, especially before perforation of the drum membrane, does not infrequently cause the most severe brain symptoms, e. g., dizziness, vomiting, deep sopor, continued deliria, convulsions, picking (Flockenlesen), marked narrowness of the pupils, irregularity of the pulse, which can disappear entirely after the pus gathered in the tympanic cavity has found an outlet through a spontaneous or artificial perforation. They are most frequently seen in children, in which the sutura petro squamosa is still open and in which the fibers of connective tissue going through it can more easily communicate a propagation of the hyperemia or inflammation from the tympanic cavity to the cranium. This can sometimes, however, occur also in adults (Schwartze)."

In my opinion it may be possible that a meningitis of a passing type is really present, namely a meningitis serosa, which has been quite frequently described of late. The anatomical conditions during early life would favor the more easy appearance of such a coaffection of the surrounding parts of the tympanic cavity.

---

*Read before the Surgical Section of the Wayne County Medical Society, March 26, 1906.

(The expression otitis media perforativa I may say, incidentally, should, I think, not be used, because it does not express a pathologic entity.)

Frank Stephenson[17] says, in part: "Regarding the etiology of insanity, it is of comparatively recent date that particular attention has been directed toward the effect upon the brain of toxins developed by fermentation and putrefaction in the gastro-intestinal tract—a faulty metabolism—and from the poisons in the blood developing from acute infections. According to Peterson: 'these toxin producing bacteria may be the chief agents the influence of which acts upon the cortical cells and nerve fibers of the brain.' It is not strange that the blood charged with these toxins should carry agents to the brain, which cause a disturbance of its functions, as we know the blood is the source of all the brain nutrition and the channel for exit of the waste material.

"In brain disorders even without any history having been given of disturbed digestion, on investigation we find evidences of extensive digestive and fermentative changes shown by urinary analysis; that is, diminished or increased specific gravity, abnormal color, a lack of proper ratio between the specific gravity and the amount of urea eliminated; the presence of indican, xanthins, urates, phosphates, oxalates, and other products. Wagner, in the *Klinische Wochenschrift,* February, 1903, reports several mental cases in which indican and acetonuria were in excess, and some of these cases characterized by severe depression left his clinic cured after three days of thorough eliminative and antifermentative treatment. The correction of these errors is also the first step in producing sleep, and in quieting the various nervous and mental manifestations in both borderline and classified insanities. We also prepare the system for making more and better blood, thus controlling not only the toxemia, but the anemia, which is sure to develop and be a stubborn factor in all these cases."

"F. Mott (*Lancet,* August, 1901) says: "The new neurology does not involve merely an acceptance of the neurone theory, but a recognition of the fact that every cell possesses a bio-chemical sensitiveness to its lymph environment, termed chemotaxis; the alteration of the environment causing, in many cases, the presence of some form of poison.

"We believe, also, that poisons circulating in the blood act as contributory, predisposing or exciting causes, in persons with a neuropathic or psychopathic heredity.

"MacPherson, at the Stirling insane asylum, reports the case of a young man of sedentary habits who was attacked with a neurasthenic anxiety and digestive cachexia with vomiting, and was so ill it was feared he would die. He recognized nobody and talked as if insane, but after purgation and vomiting excessively, he became rational, slept well, and the next morning was in his usual health.

"Of the acute infectious diseases causing or preceding mental disease or psychoses, la grippe, typhoid fever, malaria, pneumonia, acute rheumatism and neuritis doubtless head the list.

"The term post-febrile insanity is given to disorders which complicate the crisis or convalescent period of acute fevers, as malaria, scarlet and typhoid fever. Illusions, hallucinations, delusions of identity and great anxiety are the early mental manifestations."

In speaking of intoxication delirium Kraepelin[18] says: "Although in general the practical importance of the intoxication deliria is small on account of its rarity, the scientific interest which they may claim is great, because just in these forms the causative dependence of very certain mental disturbances upon distinct chemical influences upon the cortex of the brain should be clear before us. It is true this claim is met only by very few forms of this deliria. Frequently we do not know even the chemical nature of the poison itself, in other instances its modus operandi upon the nerve tissue. Above all, this is true in regard to those intoxications which are directly or indirectly caused by micro-organisms, infections, diseases, etc."

Kraepelin [19] says further: "A very important progress in the doctrine of the initial deliria is due to the fact that Nissl, in a case observed by me, could carefully examine the brain cortex. There was a considerable filling of all blood vessels, increase of leucocytes; above all, however, an extensive breaking down of the nerve cells, similar to that which is caused by artificial infection."

Kraepelin, speaking of the very extraordinary variations in the condition of nutrition of the patient and of the frequently observed continuous low temperature, says: "Just these latter points of view conduct cne from the infectious diseases understood as such to the diseases of metabolism in a more narrow sense, in which not external causes but internal disturbances in the organism create the noxious substance which infringes upon the condition of the brain or upon the working proceedings of mental events. We may expect that each morbid change in metabolism influences more or less strongly also the nutrition of the nervous system and, under certain circumstances, must allow material to enter the blood current and exercise a poisonous influence upon the same."

Speaking of affections of the digestive apparatus Kraepelin[20] says: "Disturbances of digestion, especially constipation, occur very frequently in fresh cases of insanity, but even they must be regarded as a consequence of the mentally caused irregularity of taking nourishment, and not as a cause of the same. If all mental work is very low, frequently a decrease of secretion of hydrochloric acid in the stomach seems to occur. Great variations in regard to the quantity of hydrochloric acid in the stomach are not rare in various mental disturbances. (*Leubuscher and Ziehen, Klinische Untersuchungen ueber die Salzsaure Abscheidung des Magens bei Geistes kranken,* 1892.) Defective digestion of food must probably be assumed in cases, observed once in a while, in which the body weight will absolutely not increase in spite of the immense amount of nourishment taken in with great hunger. This occurs mostly in patients suffering from paralysis and katatonia. Parasites in the intestines can cause, it seems, in children a state of delirious excitement. Taken as a whole, we know very little which is certain in regard to these conditions."

Vaughan, Sr., of Ann Arbor, in the discussion of a bacteriological paper in this society, suggested that " possibly melancholia might be due to the splitting off and absorption of the poisonous group of the proteid molecule. This poison is slowly absorbed by the intestinal canal. It produces, in animals, marked depression and lowering of the temperature conditions which we find in melancholia." (letter).

Hill Hastings[21] during the observations of a case of cerebral abscess of otitic origin, remarks in part as follows: " . . . Within 48 hours the stupor had gradually increased without any change in the general condition, and immediately operation was decided on. She could still be aroused to take nourishment, void urine or answer questions. The necessity for an operation was explained and acquiesced in by her, rather mechanically, but without evident comprehension. . .

". . . On December 17, the day following the operation, a marked change was apparent in the patient's condition. She had had a good night, was perfectly conscious, had awakened surprised at her surroundings, asked how she got to the hospital. . . . Her last recollection was of the examination made of her eyes at the house, and she had a hazy remembrance of being carried somewhere."

Voss[22] speaks of the disturbances of consciousness in otitic thrombosis. According to Voss, they are explained by disturbances of circulation and pyemic or septic infection.

Powers[23] speaking of a case of mastoiditis with aberration of minds says: "Married woman of 24, admitted to the hospital. Previous history very incomplete. She is in a semi-conscious state, very irrational, opisthotonus; head turned to the right, pupils dilated but responsive to light, no strabismus, fundus oculi normal; pulse 94; abdomen rigid, recti abdominis contracted. Insertion of speculum into left auditory canal causes patient to shudder; showed no other sign of consciousness or intelligence. Walls of canal swollen, no pus. Paracentesis brought forth a few drops of pus and blood. For two weeks incontinence of speech, afterwards slight coma off and on. Lumbar puncture revealed pneumo bacillus in fluid, some micro-organisms in ear secretion. Two weeks after admission opening into the antrum, which contained no pus, but masses of granulations. A few days after operation stupor, increased opisthotonus, on the seventh day patient is perfectly conscious, mind clear, uneventful recovery. Highest temperature 101° F.; highest pulse rate 110; leucocytes 5,200 to 7,000. Author delayed operation in this case on account of indefinite history, and the difficulty to differentiate between hysteria and non-otogenic meningitis. Also the poor condition of patient on entrance to hospital prevented narcosis and a radical operation."

Kraepelin[24] says: "We may expect that conditions of dimness of consciousness as they restrict the collecting of outer experience also restrict the further use of the incomplete observations which could perhaps still be made, because the ability to renew them is here very small and quickly disappears entirely. As grave conditions of dimness of consciousness are as a rule pretty sharply outlined as to the duration, gaps of recollection develop in this manner from which conclusion is mostly drawn that the consciousness is suspended during that period.

"Strictly speaking, the lack of recollection, the amnesia, is almost the only support which allows us with some certainty to consider a preceding loss of consciousness."

Strümpell[25] called attention to the so-called retrograde amnesia, namely to the loss of pictures of recollection for a certain period which had passed. He says: "These amnesias have been observed after injuries to the head, epileptic attacks, intoxications, etc."

The interesting relation between insanity and kidney disease is shown by Tuttle[26] in the McLean Asylum, Somerville, Mass. He quotes, among others, the following cases:

"CASE III. Mania With Distressing Delusions. No insanity in family. . . . On admission to the asylum the patient was in a state of considerable excitement. She soon mistook the nurses for people of her acquaintance who were acting as spies. She had quite constant false hearing—people upstairs were reading telegrams about her; there was a conspiracy to sell her house and take all her property; 'they' were about to publish an article in the newspapers, making all sorts of accusations against her; her food was poisoned, etc. She was in great distress of mind and showed it by her restlessness, flushed face, and mouth so dry that she could scarcely articulate. Sleep was gained only with hypnotics. This condition continued for a month; after that she gradually improved, and one morning suddenly realized that she had been sick and that the voices she had heard were not real. She was discharged recovered in two months.

"Repeated examinations of the urine showed the daily quantity to vary from 30 to 50 ounces, the specific gravity from 1,012 to 1,023. There was always a slight trace of albumin and a few hyaline, granular and occasional epithelial casts. There was no edema. There was a doubtful apex systolic murmur, not transmitted; no cardiac enlargement. There has been no opportunity for uninary analysis, but five and a half years later she was apparently in good bodily health.

"CASE IV. Mania with distressing delusions. . . . After admission the patient remained in about this condition for three and a half months, somewhat confused, walking about from place to place, looking for the people whose voices she heard; sometimes noisy, usually not; eating when urged, but sparingly; sleeping with hypnotics; always, when awake, in a state of great agitation and distress of mind. The pulse varied from 80 to 110; the temperature from 98 to 100° F. Examination of the urine showed specific gravity 1,008 to 1,025; urea sometimes increased and again diminished; a trace of albumin; hyaline, granular and epithelial casts; free blood and renal epithelium. There was edema of ankles. Heart sounds were normal. In three months she began to improve in her mental condition; the edema disappeared and most of the casts. The mental gain was not all that could be desired, for she still had false hearing when taken, at the expiration of nine months, to an asylum in another part of the country. There was also a trace of albumin and an occasional cast. Fifteen months later her husband reported that she was well mentally and that there was no evidence of renal disease."

Class III (case 9) shows in my opinion a psychosis, the origin of which is not quite clear. Whether the psychosis would have occurred simply by intoxication if there had not been present a predisposition is open for discussion. We undoubtedly had a psychosis before us, whereas in Class II we had to deal only with mental disturbances, two conditions which must strictly be kept apart from each other.

To Class I or IV, or both, belong those disturbances which may be found directly or indirectly in connection with adenoids in the nasopharynx. Unfortunately I cannot remember where I found the statement that after an adenoid operation the mental status of a child improved so much that it could leave an asylum.

The aprosexia of Guye (the inability to concentrate the attention) is a well known phenomenon.

In an interesting article on deaf-mutism by Mygind[27] we find the following statement:

"All investigations concerning the subject show that hereditary deaf-mutism is an expression of congenital deafness, whereas the heredity of acquired deaf-mutism is less pronounced. But heredity is also of some significance for acquired deaf-mutism. Deaf-mutism shows itself in a still greater degree as a hereditary condition when one makes use of the conception of heredity in order to explain in one family the frequent appearance of not only one and the same pathologic condition (homogenic heredity) but also of other conditions related to the same etiologically and pathologic-anatomically (varied heredity). It has been shown that various diseases of the middle ear and of the labyrinth occur with striking frequency among relatives of deaf-mutes, as do mental diseases, epilepsy, idiotism, stammering and other affections of speech, hysteria and other nervous diseases."

Hammerschlag[28] demonstrated an inmate of a deaf-mute institution suffering from hereditary degenerative deafness. The family history appeared to be negative. The child, eleven years old, had light blue eyes and showed a rotatory nystagmus in consequence of congenital amblyopia. The fundus was normal. The child had a very narrow forehead, a protuding upper jaw, an extremely high palate. The left testicle had not yet descended, and a white streak of hair ran from the forehead to the vertex. "The nerve status (Dr. Bonvicini) is in short as follows: The child had an uncertain broad-legged gait. The upper portion of the body wavers very distinctly forward and backward, but also sideward. When the child walks slowly it deviates very frequently to the right or to the left, so that the gait reminds one of that of an intoxicated person. The impression is created that it is more difficult for the child to walk slowly than to run, a condition which French neurologists have described under the name of 'Equilibre du vélocipéde' (bicycle equilibrium) as concomitant symptom of cerebellar ataxy. These atactic people try to save the equilibrium by running instead of walking slow, which reminds one of the efforts of inexperienced bicyclists to maintain their equilibrium by fast riding, as it is known that slow riding is much more difficult than fast riding. The boy finished his run mainly by taking hold firmly of one of his comrades." "There was very faint patellar reflexes, it may even have been absent on the right side, normal Achilles tendon reflex, very out-spoken ataxia of the upper extremities, most distinct when he dresses or undresses. The boy is a complete idiot and proved to be incapable of education. . . . "

Nadoleczy[29] says: "The results of the statistics of Bruehl and Newratzki have already proven that the number of those who are hard of hearing is considerably larger among idiots than among normal individuals. The aprosexia can, according to the views of the investigators, it is true, be added as a complicating circumstance. It shall, if present, be cured by removing the disturbances in the nose and ear, whereas the idiocy as such remains. In slight degrees of weak-mindedness the border lines can be made so uncertain that only the result of treatment can decide whether weak-mindedness or hardness of hearing, resp. nasal aprosexia, or combinations of these affections are present."

Class IV (cases 10 and 11) represents ear affections occurring during well defined and clearly recognizable psychoses.

Class V, accumulation of cerumen and foreign bodies. It is quite well known to us that the accumulation of cerumen causes sometimes more or less distress to the patient. Professor Victor Urbantschitsch[30] says: "A servant girl told me that she heard each of her thoughts plainly spoken and that she became very excited thereby. After a wad of cerumen had been removed by syringing, the hallucinations of hearing quieted down. Kessel found hearing hallucinations cured by washing out of cerumen from the left ear and tenotomy of the tensor tympani on the right ear. C. Meyer removed a wad of cerumen from a patient suffering from melancholia, whereafter the patient quickly lost the hallucination of screaming of a child and shortly recovered."

Related to these disturbances is that caused by a foreign body in the meatus. Urbantschitsch also mentions the fact that hallucinations of screaming people disappeared in a woman suffering from a chronic middle ear catarrh after he had removed the hammer.

It is of interest to learn how the subject matter appears to others. According to Ostmann[31], a psychosis can be caused in various ways from the diseased ear:

"(a) Following the ear affection circumscript hyperemia and exudations of the membranes of the brain develop which affect the gray substance of the brain. The mental disturbances caused hereby are described, without exception, as mania, states of excitement with lively motor impulses, visionary delirium and erroneous conceptions. (Wahnvorstellungen.) Not infrequently children become diseased in this manner.

"(b) The mental disturbance is set free by a pathologic reflex emanating from the ear. The reflex can exert its influence upon parts of the brain cortex either directly or, what would appear to be more probable, indirectly. The psychosis is sometimes initiated by prodromal appearances. Especially frequently wads of cerumen may influence the mind in this manner through a pathologic reflex.

"(c) (In part) Subjective noises can cause psychoses: . . . Subjective noises and delusions of hearing can exist simultaneously independent of each other. We can only speak of hearing illusions, as Koepper says, when we can draw the conclusion that the illusion is directly dependent upon the tinnitus. Otherwise, we have before us a hearing hallucination. Entotic noises can cause pychoses in predisposed people. Not infrequently the unfortunate ones commit suicide."

Also, we are confronted with the question when it is indicated to resort to surgical interference. An analogous question confronts the gynecologist. Dr. LeRoy Brown[32] says, in part:

"There are, however, some facts which I regard as well established.

"1st. If the operation, when needed has been properly done and the patient has not been mutilated by an uncalled for castration, the mental condition is never aggravated by such a procedure. This, as stated, has been the experience of Manton, who has been operating for over twenty years, also that of Picqué, whose operations have extended over a period of twelve years, of myself in the entire range of my surgical work among the insane.

"2nd. There exists among the patients confined in the various insane asylums many who are suffering in a quiet, uncomplaining way from pathological conditions. They have a right to be given relief, irrespective of their mental state.

"3d. Under the stimulus of the improved somatic state resulting from surgical relief some of the patients show greater mental changes under the moral and therapeutic care than was shown before such a relief was given. At times this improved mental state continues to one of recovery.

"The primary object of surgical operations upon the insane should be to improve the physical status of the patient, with one end only in view, of relieving them of physical suffering and nervous disturbances. If as a result of this relief they are mentally improved, it is a sequel welcomed and for which the surgeon feels doubly repaid.

It appears to me that similar rules may hold good for the ear. Bryant's views in regard to tinnitus are mentioned before. At the same time we should remember that the proximity of the ear to the brain is of signal importance. If we can assume that an irritation of the brain, directly or indirectly, in predisposed or not predisposed patients, is caused by an infection which has its seat in the ear, the indication for interference is plain.

Mueller[33] speaks of the good influence of surgical interference on neurosis complicating ear affections, e. g., epilepsy, chorea minor, hystero-epilepsy. Of his ten cases, nine patients are reported improved, one cured. In a boy with a middle ear suppuration and chorea minor, (operated upon in January, 1898) Mueller could report a complete cure also of his chorea (in 1902). He thinks the following points could be mentioned as essentially producing the good results: (1) The narcosis and the surgical shock. (2) The loss of blood. (3) The influence of the after-treatment, by which we mean the permanent drainage through the dressing.

Randolph[34] reports that "Twenty years ago Albert Robin touched upon that subject and that there was silence upon the subject for twenty years; that Toubert reported recently two cases, both affected with otorrhea. Toubert thinks that a suppurating ear is undoubtedly a form of irritation for the brain, especially when there is strong tendency to mental troubles; furthermore, that this focus can be the cause of disturbances in the neighboring circulation, or can be the source of origin of toxins harmful to the nervous system. . . . A study of Toubert's observations would seem to indicate that in a certain proportion of cases disappearance of mental trouble has undoubtedly been brought about by the cure of concomitant ear affections."

Randolph reports two cases in which the mental attitude of the patients was changed very decidedly for the better after the cure of the otorrhea. He ends by saying: "Indeed, I think the matter of sufficient importance to warrant operative measures upon inmates of insane asylums who happen to be suffering from a chronic otorrhea which antedates the appearance of the mental trouble."

I should like to state that in connection with the subject matter of this paper, it is my opinion that in the toxemic exhaustive and irritating conditions accompanying or following an inflammatory affection which has its primary seat in the ear, the patient must under certain circumstances, be considered belonging to the class of temporary mentally inferiors. This statement when first looked upon may appear a rather daring one. I am fully conscious of the fact that these conditions of mental inferiority differ from the mental inferiority as described by J. L. A. Koch to the same extent as an intoxication delirium differs from a delirium on a constitutional basis, e. g., the periodic delirium in the maniac form of periodic insanity (Kraepelin), yet there seems to exist in my mind the justification to give to the same an equal consideration in regard to the degree of responsibility as should be done in cases of mental inferiority. Koch[35] says in regard to the latter: "He who regards, however, the matter from the standpoint of medical experience, sees plainly that there exists a class of people who are insane and in whom, in consequence of diseases of the brain, the mental activity is influenced and disturbed in such a manner that the freedom of will is excluded, and that there are, on the other hand, people whose mental activity is intact in such a way that they have perfect freedom of will, but that there exists a class of people between these two groups, in whom there does not exist a complete lack of freedom of will but in whom defiencies exist based upon organic pathologic changes, when the individual is confronted, in a given case, with the alternative to decide what is right."

Considering the many variations which might be construed as symptoms of mental inferiority, I admit one almost feels that there may not be a human being, especially not among those living in the complex organization based on what we term modern civilization, which may not at one time or the other exhibit symptoms differing from the average standard of culture which in itself is a partly arbitrary creation. We must be very careful and considerate in judging about these apparent exceptions and must remember that we are practically nothing else but more or less accurate and responsive reflex mechanisms of an ever changing quality.

While, in my opinion, an intoxication caused by an ear affection may only infrequently derange a mind to the degree equivalent to a condition met with in cases of outspoken insanity, I think that a condition resembling, at least in its outer aspects, conditions met with in cases of mental inferiority, is not infrequently found, although it may only be of a temporary duration. This condition is present, however, at a time when a patient's consent to treatment is of great importance.

I am well aware that the subject is one touching upon two great realms in medicine, otology and psychiatry, two fields in which a great many questions have not yet been answered. When we consider the many various expressions of the human mind, in health, influenced by heredity, constitution, education, environment and the various ever-changing waves of bodily disposition, we can easily understand how much more difficult the explanation of abnormal mental and bodily phenomena may become in disease, especially when the recognition of the continual or fundamental pathologic state is difficult, or impossible and when the accessory cause, located in the ear, is sometimes just as difficult, or perhaps more difficult to recognize, and what is of still greater importance, when we must judge about the degree of disturbance which is to be held responsible for the result with which we are confronted. The situation becomes still more complicated if we take into consideration that the picture may be reversed in regard to the causative factor. The phenomena mentioned in some of the cases do not allow us to deny a priori the fact that the primary cause of a mental disturbance may be located in the ear. It is my opinion that an ear affection may start the vicious circle composed of the ear affection proper and e. g., the neurasthenic or hysteric conditions which latter, we know, may reach a form and a degree which sometimes allows us to classify the bearer even as insane.

In view of all the evidence, I may offer the following conclusions:

I. The ear participates in the production of mental disturbances, directly and indirectly.

II. As an organ of sense, its functional disturbance may disharmonize the normal state of thinking.

III. The mental disturbance can be brought about in two ways: First, by causing hallucinations, respectively, illusions, the influence of which is more or less strong according to the predisposition of the afflicted individual.

IV. Entirely different from these disturbances are those in which the ear and its surrounding parts are simply the place in which a toxemia is primarily created, or in which an abscess engages the vitality of the body.

V. Both conditions (3 and 4), while entirely different from each other clinically and pathologically, can produce mental disturbances and aggravate pre-existing mentally abnormal conditions.

VI. It is very probable that also without a pre-disposition a mental disturbance can be created if, e. g., the annoying subjective noises create a state of exhaustion, e. g., neurasthenia.

VII. These conditions are of great import from a forensic point of view and must be considered in declaration of witnesses.

VIII. We are confronted with the important question whether the consent to an operation is required of an adult patient whose mental activity is temporarily interfered with and who is unable to judge about his condition, also if the consent of the relatives is necessary in such a case.

IX. The organs of hearing of inmates of insane asylums should be examined.

X. Patients suffering from mental disturbances who exhibit phenomena on the part of the organ of hearing should be examined not only for pathologic conditions of the ear but also of other organs, e. g., of the kidneys, on account of the fact that the disturbance in the ear, although in itself a new centre, may only be a reflex disturbance.

XI. The benefit of surgical interference in ear affections should be bestowed upon the insane in need of it.

REFERENCES:

[1] "A Report of a Case of Caries of Part of the Temporal Bone, with a Deep Abscess of the Neck." Physician and Surgeon, Detroit and Ann Arbor.

[2] "Some Practical Thoughts Regarding Affections of the Ear." The Physician and Surgeon, Detroit and Ann Arbor, December, 1901.

[3] Schwartze's Handbuch, Vol. I., p. 527.

[4] Schwartze's Handbuch der Ohrenheilkunde, Vol. I., p. 412.

[5] "Tinnitus Aurium, Diagnosis and Differentiation." Transactions of the American Otological Society, 1904.

[6] "The Treatment of Tinnitus Aurium." The Laryngoscope, July, 1904;

[7] "Capital Operations for the Cure of Tinnitus Aurium." The Journal of the American Medical Association, Dec. 9, 1905.

[8] Dr. Edward R. von Hofmann, "Lehrbuch der Gerichtlichen Medicin." Seventh Edition, Wien, 1895, p. 919.

[9] Schwartze's Handbuch, Vol. II., p. 546.

[10] "Tinnitus Aurium and Hallucinations of Hearing, or Relations of Ear Disease to Auditory Hallucinations of the Insane," in Annals of Otology,

Rhinology and Laryngology, September, 1905.

[11] "Handbuch der Gerichtlichen Psychiatrie," Berlin, 1901, p. 422 and following.

[12] "In Blau Encyklopaedie der Ohrenheilkunde," 1900, p. 149.

[13] E. Kraepelin, Psychiatrie, 1896, p. 102.

[14] Zur Frage des Gedankenlautwerdens" (concerning the becoming loud of thoughts), Berlin, 1899.

[15] Schwartze's Handbuch, Vol. II., p. 220.

[16] "Lehrbuch der Ohrenheilkunde," 1898, p. 198.

[17] "Toxemia and Infections as a Cause of Insanity," Buffalo Medical Journal, January, 1905.

[18] l.c., p. 356.

[19] l.c., p. 359.

[20] l.c., p. 49.

[21] California State Journal of Medicine, October, 1905.

[22] Reviewed in the Monatsschrift für Ohrenheilkunde, December, 1905,1,2.

[23] G. H. Powers, Journal of Medicine, San Francisco, Reviewed in the Medical Fortnightly, Nov. 25, 1904.

[24] l.c., p. 108.

[25] Dritter Internationaler Congress für Psychologie in Munich, 1896.

[26] "Kidney Disease and Insanity," American Journal of Insanity, April, 1892.

[27] Blau Encyklopaedie der Ohrenheilkunde, 1900.

[28] Meeting of the Austrian Otologic Society, Oct. 30, 1905, Reported in Monatsschrift für Ohrenheilkunde, Etc., December, 1905, p. 534.

[29] "The Oto Rhinologic School Examinations of the Year," 1902-1903, Internationales Centralblatt für Ohrenheilkunde, February, 1906.

[30] Schwartze's Handbuch, Vol. I., p. 412.

[31] Blau's Encyklopaedie, 1900, p. 149.

[32] New York Medical Journal, New York, Jan. 21, 1906, "The Present Status of Surgical Operations on the Insane."

[33] Archiv für Ohrenheilkunde, Vol. 54, p. 223, "Neuroses and Mastoid Operations."

[34] Progressive Medicine, Vol. I., March, 1905, p. 220.

[35] Die Psychopathischen Mindenwertigkeiten." Part I., p. 134.